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PAR 253A

Stereogram Printer
Optical Development

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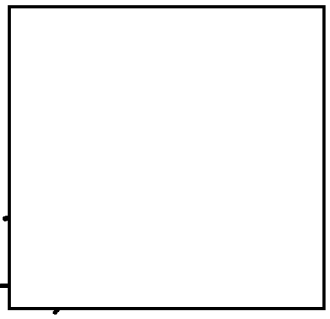

18 March 1970

Declass Review by NGA.

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REVISION BACKGROUND

The original PAR 253 proposal for the development of an optical system for the reproduction of stereo image pairs on stereogram format included the fabrication, testing, and evaluation of kluge equipment.

Optical design effort, however, has been redirected by the customer to yield a system which he feels will be more compatible with existing stereo viewing microscopes. The revised design goal of variable magnification over a 2X to 4X range requires maintaining the original resolution goal of 200 cycles/mm over a much increased object format. Since this is a much more difficult task for the lens designer, it will not be possible to complete the optical design, lens fabrication, and photographic testing as originally proposed, within the time and funds remaining. For this reason, we are submitting, at the customer's request, this revised proposal which limits the scope of work to optical design only.

Changes in the text of the approved PAR 253 proposal that result from this revision are indicated by *italics*.

PROJECT AUTHORIZATION REQUEST

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SUBJECT: Stereogram Printer Optical Development

TASK/PROBLEM

1. *Study the feasibility of and design an optical system for the reproduction of a stereo-image pair in stereogram format.*

PROPOSAL

2. Introduction:

a. For maximum information retrieval from stereo mission material now being acquired, special complex and expensive stereo registration equipment has been developed. Although this equipment would permit comfortable stereo fusion for observers by scale matching and image rectification, its expense restricts its availability to a limited number of users.

b. The importance of making fuller use of currently available stereo materials has prompted consideration recently of combining the registration technique described above with a special optical printer system that could produce stereograms* in quantity. This approach, if successful, would make high-quality stereo views of selected targets readily available to PI's for use in low magnification, low-cost, desk-top stereoscopes.

3. The following are considered to be requirements for such a printer optical system:

a. High-quality reproduction of state-of-the-art imagery that results in maximum information preservation.

b. Accurate matching of pairs by the system after only approximate image matching by the operator.

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* Stereogram - A matched pre-aligned stereo pair readily capable of fusion by an observer using a simple stereo viewer.

c. A high production rate resulting from the capability for a relatively short exposure time on print stock materials such as SO-239 reversal film. Since multiple duplication of each stereo scene is an important objective, consideration will be given to roll feeding of the print stock *if* the design of a production printer is undertaken.

4. It is the intent of this PAR to investigate the feasibility of an optical system that is necessary to the concept of a stereogram enlarging printer. The decision to design and fabricate such a printer may be based on the results obtained under this PAR.

5. *Preliminary Optical Design Parameters:*

a. It was originally proposed that system magnification fall in the 5X to 15X range. However, to maximize compatibility with zoom stereo microscope viewing equipment already in common use, the customer requested that the system be designed to provide a minimum magnification of 2X. A 2:1 zoom magnification range would then provide working magnification variable from 2X to 4X.

b. A resolving-power design goal of 200 cycles/mm when reproduced from a USAF 1951, standard three-bar, high-contrast target has been established and is considered highly desirable.

c. The system will be zoom anamorphic; that is, its magnification will be continuously variable on one plane over a finite range. *A 2:1 anamorphic range has been selected as adequate. It has been agreed with the customer that a 0.7 to 1.4 range working in both directions from unity will be acceptable.*

d. The relative aperture of the *lens system* will be established as design development progresses.

e. The illumination system *would* be a specular, condenser-type system using a tungsten lamp to provide necessary source intensity control. This system must necessarily be tailored to work with the objective lens system.

6. Objective and Condenser Lens Design:

a. Under the original PAR, a system design approach utilizing cylindrical doublets for the anamorphic zoom elements was undertaken. This design displayed early potential for meeting the system requirements. However, as work progressed it became apparent that the resolving power of the designed system would fall short of the desired goal, particularly near the 2X lower limit of magnification.

b. Other approaches will be considered. These will include the use of achromatic wedges to achieve the necessary anamorphic zoom effect. It is felt that this type of anamorphic system may simplify the correction of aberrations to the high degree necessary to achieve the resolving power goal.

c. As optical design effort progresses, the resulting formulae will be evaluated to provide a means of comparing various designs. Assuming that a feasible approach can be developed, optical design effort will be continued either until the completion of an acceptable lens formula or until the expiration date of this PAR necessitates termination of effort. Should the customer decide upon fabrication and testing of the optical system, that effort would become the subject of another contract.

PROGRAM OBJECTIVE

7. Determine the feasibility of an optical system for an Enlarging Stereogram Production Printer.

SCHEDULE

8. A tentative schedule covering the major phases of effort is shown in Figure 1. Changes in this schedule that may be necessary as work progresses will be reviewed with the customer.

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TENTATIVE SCHEDULE

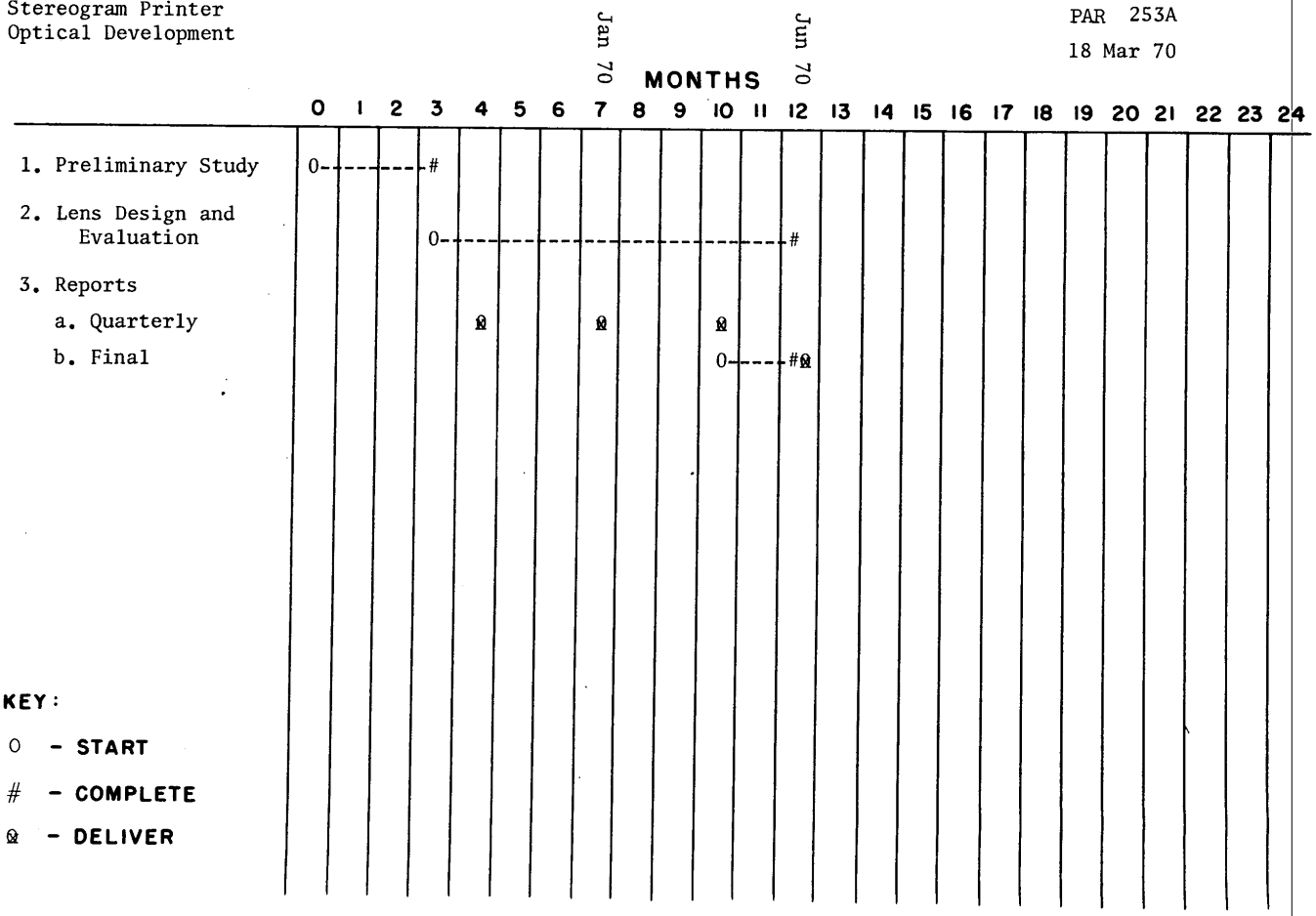

Figure 1

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